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ARMY MEDICAL RESEARCH AND DEVELOPMENT TECHNICAL REPORT.(U)
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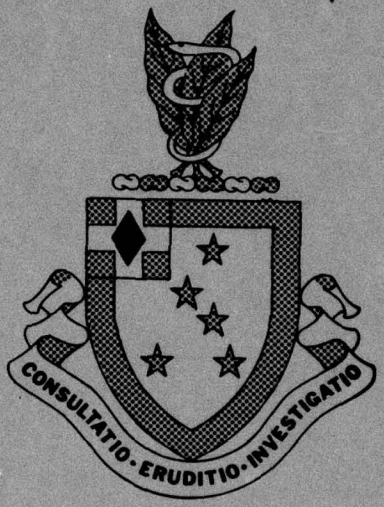

1 October 1977 - 30 September 1978

U.S. ARMY
MEDICAL RESEARCH AND DEVELOPMENT REPORT
RCS MEDDH-288 (RI)

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	Food	Laboratory Animals

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The research projects reported in this Progress Report are as follows:

(16) Project: Army Aviation Medicine (3E162773A819)
Project: Environmental Quality Protection (3E162720A835)
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U.S. ARMY RESEARCH AND DEVELOPMENT

TECHNICAL REPORT

RCS-MEDDH-288(R1)

ARMED FORCES INSTITUTE OF PATHOLOGY

Washington, D.C. 20306

ANNUAL PROGRESS REPORT

1 OCTOBER 1977 - 30 SEPTEMBER 1978

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

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(U) Dynamics of Aircraft Accident Victims; Computer Simulation

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13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
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19. RESPONSIBLE DOD ORGANIZATION

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ASSOCIATE INVESTIGATORS NAME: McMeekin, Robert R., M.D. LTC, MC/FS, USA

NAME:

21. GENERAL USE

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Computer Simulation, (U) Aircraft Accidents, (U) Occupant Kinematics, (U) CALSPAN three-dimensional program model

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23(U) Computer simulation of the kinematics of occupants in selected aircraft accidents in order to recreate the sequences of injuries and to determine their specific cause(s). This will lead to an increased understanding of the pathogenesis of such injuries and lead to more effective means of preventing them. Examine feasibility of running concurrently the KRASH vehicle impact simulation code so as to enhance the realism of occupant-vehicle interaction.

24 (U) Operate the CALSPAN three-dimensional program as a model using selected Aerospace Pathology Division cases as sources of input data. Correlate the actual injuries observed at autopsy with the injuries predicted from the occupant kinematics of the computer simulation. Use the optimal output features of the CALSPAN code, using subroutines to calculate injury severity indices and time points of maximum injury.

25 (U) 7710-7809. The usefulness of the CALSPAN three-dimensional program model has been demonstrated for three primary situations. These are: (1) low-velocity fixed wing aircraft accidents; (2) rotary winged aircraft accidents; (3) out-of-envelope ejections with partial man-seat separation. The need for improvement to the program centers about three areas: (1) the need for a simplified input deck with greater flexibility in selection of altitude; (2) the need for post-processing for analysis of injury data and (3) the need for a programmable deformation of the "vehicle" during a crash pulse. The CALSPAN three dimensional program model, in its present form, is more useful as a research and development tool rather than a day-to-day tool for the investigation of routine accidents.

*Available to contractors upon originator's approval.

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Project No. 3E162773A819(con't)

Title: Dynamics of Aircraft Accident Victims: Computer Simulation

References:

1. "Validation of the CALSPAN Gross-Motion-Simulation Code With Actually Occurring Injury Patterns in Aircraft Accidents", Aviation Space and Environmental Medicine, January 1978, Vol. 49, Section II, p.191-195.

ANNUAL PROGRESS REPORT

TITLE PAGE

Project No. 3E162773A819 Title: Dynamics of Aircraft Accident Victims Computer Simulation

Task No. 00

Name and Address of Reporting Installation:

Armed Forces Institute of Pathology
Washington, D. C. 20306

Name of Department: Aerospace Pathology Division

Period Covered by Report: 1 October 1977 - 30 September 1978

Professional Authors: J. M. Ballo, LTC, MC, USA
R. R. McMeekin, M.D., LTC, MC/FS, USA

Report Control Symbol: RCS-MEDDH-288(R1)

Security Classification: Unclassified

BODY OF REPORT

Project No. 3E162773A819 Title: Dynamics of Aircraft Accident Victims Computer Simulation

Task No. 00

Experience in the use of the Calspan three-dimensional program model has been documented over the past several years and has involved progressively more complicated versions of the model. The use of the restart and of the automatic positioning options has increased the efficiency and versatility of the program but has not materially made the application of the program easier. In order to accurately simulate the sequence of events producing real injuries, three additional modifications would be of value.

(1) Pre-processing: The present input "deck" is very closely cued to a particular vehicle configuration. Changing one feature very often produces the need for changes in other portions of the input data. A simplified "pre-processor" routine, preferably using an interactive CRT display to enter changes in input data is needed before the model is flexible enough for any routine service applications.

(2) Post-processing: Features already exist in the program to produce a post-processing output. Most of the output of the program is not pertinent to the time of production of a particular injury. Post-processing routines should be able to identify time period of peak structural and body segment deformations, accellerations and loadings and to translate these raw values into biologically meaningful parameters such as Head Injury Criteria.

(3) Vehicle Deformation: At the present time there is no option for allowing for vehicle deformation during impact. These are of two types: the first is deformation affecting the distances between the two aircraft structures, e.g. the seat pan and the windscreen. The second is the deformation that occurs when a body segment interacts ("strikes") a structure. Many of the vehicle deformation programs (e.g. KRASH) are of the finite element class and difficulties would be expected in adapting them to dynamic models such as CALSPAN'S.

Finally, the most difficult problem in adequate simulation efforts is the inability of the model to realistically simulate "two-pulse" inputs. This is because the joint and position characteristics of the occupants would change in an unpredictable fashion after the initial impact and also because of the problem of vehicle deformation alluded to above. As a practical matter, it is difficult to accurately reconstruct even a fair approximation of the accelleration pulse(s) taking place during an actual accident.

Title: Dynamics of Aircraft Accident Victims - Computer Simulation

The CALSPAN three dimensional program model is, in its present form, more useful as a research and development tool rather than as a day-to-day investigative technique for the investigation of the routine accident. In the former situation, the crash pulse may be carefully defined and simplifying assumptions as to attitude and loading may be made. In selected real-world accidents, it is possible to accurately simulate the production of injuries but this is not the case in the majority of instances.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

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77 10 01	D. Change	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

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11. TITLE (Precede with Security Classification Code)

(U) Analysis of Cytotoxic Reactions Produced by MUST-Water Constituents

12. SCIENTIFIC AND TECHNOLOGICAL AREAS

007800 Hygiene and Sanit., 005900 Environmental Bio., 009800 Med. & Hosp Eq.

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e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE

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FISCAL YEAR PRECEDING 77		8.
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19. RESPONSIBLE DOD ORGANIZATION

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NAME:

21. GENERAL USE

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Cytologic Water Purity Assay, (U) Quantitative Cytomorphology, (U) Analysis of Cytologic Images, (U) Cytologic Pattern Recognition

23. TECHNICAL OBJECTIVE, 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) Develop cytoassay for detection of impurities by their measurable effects on cellular morphology. Intended application is faster, lower cost monitoring of waste water. Effects are measured computer images of cells exposed to toxicants in culture.

24. (U) Fabricate cell image scanning system based upon computer controlled light microscope densitometry. In addition to purchase, this includes development of both hardware and software. Run feasibility experiments with model toxicants.

25. (U) 7710-7809. Hardware development completed. Image acquisition software completed. Acquisition of cellular images from controlled experiments with model toxicants, 75% completed. A data bank of cellular images on magnetic tape is being compiled.

*Available to contractors upon originator's approval.

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ANNUAL PROGRESS REPORT

TITLE PAGE

Project No. 3E162720A835 Title: Analysis of Cytotoxic Reactions Produced by MUST-Water Constituents

Task No. 00

Name and Address of Reporting Institution:

Armed Forces Institute of Pathology
Washington, D.C. 20306

Name of Department: Cellular Pathology

Period Covered by Report: 1 October 1977 - 30 September 1978

Professional Authors: Joseph A. Boccia, LTC, MC, USA
Gunter F. Bahr, M.D., Chairman, Cellular Pathology

Report Control Symbol: RCS MEDDH-288(R1)

Security Classification: Unclassified

BODY OF REPORT

Project No. 3E162720A835 Title: Analysis of Cytotoxic Reactions Produced by MUST-Water Constituents

Task No. 00

Summary

A computer assisted scanning light microscope system for obtaining computer pictures of biologic cells is now in full operation in the Department of Cellular Pathology. The scanning system is applied to the acquisition of computer images of cells which have been exposed to model noxious chemical agents for varying amounts of time and in varying concentration of agent. Additional personnel for operation of the scanning system have been trained. Over one thousand test cells have been scanned and recorded in the Department's computer image bank. Progress towards analysis of these computerized cellular images has been made, but has been made more slowly than originally anticipated due to temporary shifts in the allocation of departmental manpower necessary to cover other mission requirements of the AFIP. Both data (image) acquisition and development of image analytic and reporting capability are currently ongoing. Improvements to the efficiency with which the scanning system performs have been made based upon experience in its daily operation.

Data Acquisition

At this writing, 785 cellular pictures have been computerized by the scanning procedures implemented in this system. These images are obtained from cultured Mouse-L cells, clone 939 which have been exposed to Dinitrophenylhydrazine (DNPH) and Reverse Osmosis Permeate (ROPM) concentrate. The latter is a resin used in the production of reuse-water. The scanning of ROPM exposed cells is not complete at this time. Figure 1 indicates the numbers of DNPH exposed cells which have been scanned. Figure 2 summarizes the same data for ROPM exposed cells.

The cells currently scanned were supplied from cultures performed at the Sloan Kettering Laboratory in Cincinnati, Ohio. They were stained at the Department of Cellular Pathology, Armed Forces Institute of Pathology, with the Feulgen method for DNA and counterstained with Napthol Yellow. The latter stain is considered to produce a tinctorial effect proportional to the amount of cellular protein present. All cells were grown on glass coverslips and exposed to the particular noxious agent for one, two, three, and four days respectively. The specific concentrations of toxicant used are indicated in Figures 1 and 2. In the case of ROPM concentrate, Figure 2 presents the percentage dilution of concentrate to which the subject cells were exposed.

Title: Analysis of Cytotoxic Reactions Produced by MUST-Water Constituents

EXPERIMENTAL MATRIX FOR MUST-DNPH-02

Concentration of DNPH in mg / L	Exposure Time (days) 1	2	3	4	Total
0.00	26	none	26	25	77
0.10	25	26	25	25	101
0.32	26	25	25	25	101
1.00	26	25	25	25	101
3.20	27	25	24	26	102
10.00	25	none	25	25	75
Total	155	101	150	151	557

FIGURE 1: Numbers of DNPH Exposed Cells

Note: For each concentration and time of exposure shown, the matrix entry indicates the number of exposed mouse-L, clone 939, cells which have been scanned and recorded on magnetic tape for subsequent analysis.

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EXPERIMENTAL MATRIX FOR MUST-ROPM-01

Exposure Time (days)

	1	2	3	4	Total
0.00%	25	26			51
1.00%	25	26			51
3.20%	25	25			50
5.60%	25				25
10.00%	26				26
18.00%	25				25
Total	151	77			228

FIGURE 2: Numbers of ROPM Exposed Cells

Note: For each concentration (expressed as percentage of RO Permeate concentrate dilution) and time of exposure shown, the matrix entry represents the number of cells (mouse-L, clone 939) which have been scanned and recorded on magnetic tape for subsequent analysis. Those matrix positions which have not yet been filled represent populations of scanned cells not yet obtained.

Title: Analysis of Cytotoxic Reactions Produced by MUST-Water Constituents

All cells, to date, have been scanned under filtered trans-illumination, using a bandpass filter with peak transmission at 560 nanometers. This is close to the absorption maximum for DNA stained with the Feulgen method. Using the interactive tracing method described in previous annual reports (1977 and 1976), the cellular border and nuclear border of each test cell has been delineated by drawing over them with the scanning microscope's eye-piece crosshairs under the control of a high precision, on-line digital joystick. The trajectories so indicated are memorized by the scanning system and recorded along with the computer image of the test cell for subsequent use during analysis. These tracings may, therefore, be regarded as contour overlays for the cell picture.

Each cell scanned and recorded by this system may be considered pre-cleaned of unwanted, neighboring detail. Only the subject test cell appears in each computer picture. This is accomplished using the mechanism of tracing a trajectory identified as the scanning perimeter. This is a closed contour which surrounds the selected cell, but excludes any neighbors which may be present on the slide. Also excluded is any nearby debris which might offer problems to subsequent analysing computer algorithms. By performing this interactive tracing at the time of scanning, a more complex and less certain process of post-cleaning on a CRT terminal after scanning is avoided. In balance, approximately ten minutes per cell picture is saved - exclusive of any time spent waiting for availability of the computer system upon which such post-cleaning is implemented.

The cellular images are recorded upon 1/2 inch, 9 track, industry compatible magnetic tape in a data format which is specified for all images produced in this laboratory. The gray value for each picture element (pixel) is gotten by measuring the optical density of adjacent 0.5 x 0.5 micron square areas over the cell's extent. Each pixel's gray value datum is recorded as the integer portion of the OD multipled by one hundred. This is given by the following formula:

(1) gray value - integer portion (100 x optical density).

Since the microdensitometer of the scanner returns densities in the range of 0.00 to 2.00, all recorded gray values are in the whole number range 0 to 200 and are, therefore, captured in eight bits of computer information. The raw optical density which is used in the calculation indicated by formula (1) above is itself the arithmetic average of 2 independent measurements made over the pixel position.

The format for recording cell pictures on magnetic tape separates the image into two portions which collectively are referred to as a digital image, or simply image when understood in context. The two portions are referred to as the associated data and pixel data respectively. In turn, the associated data is comprised of parametric and graphic data. Graphic data consists of the tracings performed by the scanning operator and are essentially special trajectories which can be subsequently used as image overlays. The parametric data items are alphanumeric values required for subsequent utilization of the data tapes and scientific interpretation of analytic results. In particular, relevant experimental conditions are described among this data. Figure 3 depicts some of the associated data which are recorded for a cell picture, numbering some 63 items in each instance. All associated data items are not shown in Figure 3. Both associated data and pixel data are blocked for increased storage efficiency on magnetic tape. It has been possible to record, in this manner, more than 500 cell pictures per 2,400 ft. reel of magnetic tape. Each cellular picture is not less than 10,000 pixels in size. This has proved to be a considerable improvement in storage efficiency over systems previously used by this laboratory.

New Chief Operator Trained

In order to compensate for the anticipated loss of the current chief system operator, it has been necessary to train another individual for the position. This person has responsibility for operating the scanner, and must also trouble-shoot, train, and supervise others assigned the task of capturing cell images. Replacement of the current Chief Operator has been accomplished by training a DA civilian for the task. Under the guidance of the Chief Operator, the learning time required to independently scan cells is 20-40 hours, depending upon previous level of familiarity with operation of the light microscope and technical biologic background. No previous computer experience is required (supplied by Chief Operator), nor is any typing ability. (A knowledge of typing will, however, improve the rate of cell image capture which any particular operator may achieve.)

Improvements in Scanning Efficiency

Scanning system maintenance changes have been made in response to specific operator suggestions arising from actual operations experience when such suggestions were considered feasible. These have been generally in the nature of fixes for convenience or the removal of defects. Since these changes do not alter the basic characteristics of the system as presented in previous annual reports (1976, 1977), no further discussion will be devoted to these changes here.

However, several improvements in the basic performance characteristics of the system have been accomplished. They are aimed at increasing image capture rate and quality. The enhancements involve improvements to both hardware and software.

Title: Analysis of Cytoxic Reactions Produced by MUST-Water Constituents

FIGURE 3

TABLE OF ASSOCIATED DATA ITEMS

1. image name
2. image size (number of lines and pixels per line)
3. interpixel distance (distance between adjacent pixels)
4. scanning instrument identification
5. reference mark number (there are four marks per slide)
6. number of measurements averaged per pixel
7. number of image copies (each representing different wave length)
8. date of cell scan
9. name of scan operator
10. time scanning session began
11. experiment identifier
12. slide identifier
13. fixatives used
14. stains used
15. filter identifier
16. calibration co-ordinates for microdensitometer
17. transillumination bulb voltage
18. background calibration value (set to zero transmittance)
19. immersion oil refractive index
20. numerical aperture of condenser
21. numerical aperture of objective
22. objective magnification
23. tube magnification
24. pre-phototube ocular magnification
25. scan spot edge (diameter) length (in microns)

Title: Analysis of Cytotoxic Reactions Produced by MUST-Water Constituents

Photometer Head Replacement

A new Zeiss photometer head (optics) has replaced the previously used model. This allows more perfect alignment of the 0.5 x 0.5 micron scanning spot and eyepiece crosshairs. The ultimate benefit achieved is a more reproducible and accurate geometric relationship between tracings done with on-line joystick and the digital cell image itself. At any point in the scan, the scanning spot is centered with greater accuracy on the point in the cell which is overlain by the crosshairs' intersection. With the previous photometer head, this alignment was cumbersome to achieve and difficult to maintain. With the new head, the scanning spot and crosshairs are simultaneously viewable and can be easily aligned by controls provided on the photometer head. These controls allow the scanning spot to be centered on the crosshairs' intersection. An added benefit of the new photometer head is that it permits viewing of the cell through the microscope while the scanning is being performed. This permits periodic operator verification of the scanning boundaries, with assurance that the entire cell is scanned and no unwanted detail included.

Finer Joystick Control of Motorized Stepping Stage

The fidelity of stage response to operator manipulation of the on-line joystick has been enhanced by the mechnism of a better software algorithm for reading the joystick information transmitted to the computer when the operator exerts pressure in any particular direction. The effect is one of closer adherence of the crosshairs' intersection to the cellular structure being traced. That is, the crosshairs' intersection and joystick behave more nearly like a pencil - making the graphic editing of the cellular image more like ordinary tracing. The result is more accurate determination of cellular structures, such as cell border and nuclear edge. This has proven of particular value in tracing around the cytoplasmic processes of stellate and fusiform cells, which is frequently the case for control or only slightly intoxicated cells. Similar statements apply to the accuracy with which the nuclear edge of small, shrunken severely intoxicated cells is traced.

Reduced Physical Scanning Time

The time taken to acquire a single cellular image can be divided into two distinct periods. First, there is that required to search and randomly select a cell, name it, mark its location on the slide for registration as a parametric, associated image data item, and then graphically edit it by making any required tracings. Currently, tracings of a scanning perimeter, nuclear edge, and cellular border are required. For the cell sizes being edited and the tracings required, it is now taking approximately eight minutes to accomplish these tasks.

The second period of time required to acquire a single cell picture is that of physically scanning the cell. This is the process of measuring each of the gray values for the respective pixel positions in the image. It involves stepping the motorized stage and triggering a measurement at each adjacent pixel, beginning a new scan line after reaching the furthest extent of the current one, and stopping the process when the last scan line has been measured. By improvement in the software algorithm which governs the physical scanning process, a reduction of 40-50% in the physical scan time of most cells has been accomplished. The cells for which the greatest savings have been accomplished are the ones which have presented the greatest scan time overhead.

Cells of irregular shape, such as fusiform or stellate configurations, have typically taken longest to physically scan. For these, there tends to be wide expanses of microslide within the framing rectangle which are not occupied by cellular protoplasm. In particular, the concavities between protoplasmic extension of stellate cells are an example. Among the improvements in the physical scanning algorithm now employed is confinement of physical motion to the portions of the microslide which are overlain by the cell - regardless of how irregular its shape. Previously, the entire framing rectangle was passed over, with data taken only on or within the scanning perimeter. Now, physical motion is also confined to pixels on or interior to the scanning perimeter.

Improvements in the physical scanning algorithm's handling of the data transfer to magnetic disc have further reduced scan time. The total cellular picture is decomposed into sections of two sizes. For storage on disc, the picture is segmented into square sections of 16 x 16 pixels each. A picture stored on disc, therefore, takes the form of a sequenced train of records containing 256 pixels each. In computer main memory, a picture square section which is 48 x 48 pixels, or 9 continuous 16 x 16 sections, is maintained. The advantages gained in using these techniques include: 1) image size is constrained only by the size of disc file allocated for picture storage, and 2) there is no constraint on image size placed by available main memory. The disadvantage of this approach is the input/output overhead which must be paid for the image sectioning. This overhead has been considerably reduced by improvements to the physical scanning algorithm software. Though there still is some overhead, it is acceptable and the trade-off more than justified considering some cells scanned are quite large. there would be insufficient memory for both program and data if these large cells were scanned in such a way that either the entire cell, or even entire scan lines, had to be kept in main memory during digitization.

CRT Replacement of Teletype Operator's Console

The scanning system is a highly interactive one in which an operator must direct system function with commands from a keyboard input device.

This purpose was previously served by an ASR-33 teletype. An analysis of operations with this teletype revealed that approximately 25% of an operator's scanning time was spent awaiting completion of typewritten instructions from the system regarding the next input required. Such instructions are necessary to prevent error and reduce learning time on the system. However, once skilled in its use, an operator is capable of assimilating these instructions much faster than a teletype can print. In fact, the operator is usually ready to respond to the next system nearly instantaneously after a previous input. For a skilled operator, therefore, the 25% wait time can be essentially eliminated, if system messages can be displayed in negligible time.

This has been, in effect, accomplished by converting the system to interact with an operator at a CRT set to display printed messages at very high speeds - in this case 9600 baud. Messages are now nearly instantaneous. The cell picture acquisition rate has correspondingly increased in number of cells scanable per session of 4 hours. Correlary benefits have been: easier operation in subdued lighting, quiet operation resulting in less disturbance to other laboratory activity, and reduced scan operator fatigue.

Analysis of Acquired Cell Pictures and Reporting of Results

Progress in this direction was made at slower than the anticipated rate because of the periodic necessity for reallocation of manpower to other AFIP mission requirements. Particularly in the area of software development required for analysis, progress has been retarded in comparison to that anticipated beginning this reporting period. At this writing, effort is again directed fully to this software development. At present, no further interruption of this process is foreseen. Barring intercurrent suspense of work in this direction, analysis of acquired cellular pictures and generation of final results report should occur approximately 1 July 1979.

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY

1. AGENCY ACCESSION*	2. DATE OF SUMMARY*	REPORT CONTROL SYMBOL
DA OB 6605	78 10 01	DD-DR&E(AR)636

3. DATE PREV SUM'RY	4. KIND OF SUMMARY	5. SUMMARY SCTY*	6. WORK SECURITY*	7. REGRADING*	8a. DISP'N INSTR'N	8b. SPECIFIC DATA - CONTRACTOR ACCESS	9. LEVEL OF SUM
77 10 01	D. Change	U	U		NL	☒ YES ☐ NO	A. WORK UNIT

10. NO./CODES:*	PROGRAM ELEMENT	PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.47.13.A	1J664713D47	00	001
b. CONTRIBUTING				
c. CONTRIBUTING	CARDS			

11. TITLE (Precede with Security Classification Code)*
(U) Lesions in Animals Fed Enzyme Inactivated Frozen and Irradiated Meats

12. SCIENTIFIC AND TECHNOLOGICAL AREAS*
006500 Food; 014100 Radiobilogy

13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD
71 07 01	CONT.	DA	C. In-House

17. CONTRACT/GRANT
a. DATES/EFFECTIVE: EXPIRATION:
b. NUMBER:*
c. TYPE: d. AMOUNT:
e. KIND OF AWARD: f. CUM. AMT.

18. RESOURCES ESTIMATE		a. PROFESSIONAL MAN YRS	b. FUNDS (In thousands)
FISCAL YEAR	PRECEDING 77		49.
	CURRENT 78		49.

19. RESPONSIBLE DOD ORGANIZATION
NAME:* Armed Forces Institute of Pathology
ADDRESS:* Washington, D. C. 20306

RESPONSIBLE INDIVIDUAL
NAME: Cowart, E. C. Jr., CAPT MC USN
TELEPHONE: 202-576-2905

21. GENERAL USE

20. PERFORMING ORGANIZATION
NAME:* Armed Forces Institute of Pathology
ADDRESS:* Washington, D. C. 20306

PRINCIPAL INVESTIGATOR (Furnish SSAN if U.S. Academic institution)
NAME:* Casey, H.W., Col., USAF, VC
TELEPHONE: 202-576-2601
SOCIAL SECURITY ACCOUNT NUMBER:

ASSOCIATE INVESTIGATORS
NAME: Stedham, M.A., LTC, VC, USA
NAME: Trucksa, R.C., MAJ, VC, USA

22. KEYWORDS (Precede EACH with Security Classification Code) (U) Food, (U) Radiation, (U) Sterilization, (U) Meat, (U) Experimental, (U) Laboratory Animals

23. TECHNICAL OBJECTIVE,* 24. APPROACH, 25. PROGRESS (Furnish individual paragraphs identified by number. Precede text of each with Security Classification Code.)

23. (U) To determine the wholesomeness for human consumption of radiation sterilized meat by studying the pathologic effects, if any, of feeding dogs, rats and mice irradiated meat. Preservation of food is vital to military operations.

24. (U) The U.S. Army is conducting contractual studies on the wholesomeness for human consumption of radiation sterilized meat. Pathological results obtained from experimental animals will be statistically analyzed and submitted together with other experimental data to the FDA and USDA to establish a regulation permitting unlimited consumption of radiation sterilized meat. The AFIP serves as monitor and reviewer of the pathologic findings in the contractor's experimental and control animals.

25. (U) 7710-7809. AFIP pathologists performed five site visits to contractor's laboratories during the year. Two hundred seventy-eight cases consisting of 3,974 paraffin blocks were accessioned in the AFIP Registry of Veterinary Pathology. Two hundred twenty of these cases were from the beef study performed by Industrial Biotest Laboratories. Pathology review indicated that Biotest diagnoses and characterization of lesions in both control and experimental animals were at an acceptable professional level. However, numerous errors in the transcription data were noted together with numerous missing tissues. Pathology studies in these animals was stopped when the Biotest Laboratory contract was terminated on Oct 77. Since Dec 77 major emphasis has been placed on the chicken study performed by Raltech Scientific Services, Inc. A system for coding the distribution, severity and duration for all lesions has been developed that is amenable for computer storage and retrieval. In addition notation will be made of all organs examined including those without lesions assuring that the pathologic data will permit the computation of incidence tables for each type of lesion in relationship to the major experimental variables. Based on the review of a limited number of cases Raltech's performance of pathology studies has been satisfactory.

*Available to contractors upon originator's approval.

ANNUAL PROGRESS REPORT

TITLE PAGE

Project No. 1J664713D47

Task No. 00

Title: Lesions in Animals Fed Enzyme Inactivated Frozen and Irradiated Meats

Name and Address of Reporting Installation:

Armed Forces Institute of Pathology
Washington, D. C. 20306

Name of Department: Veterinary Pathology

Period Covered by Report: 1 October 1977 - 30 September 1978

Professional Authors: H. W. Casey, Colonel, USAF, VC
M. A. Stedham, LTC, VC, USA
R. C. Trucksa, MAJ, VC, USA

Report Control Symbol: RCS MEDDH-288(R1)

Security Classification: Unclassified

BODY OF REPORT

Project No. 1J664713D47 Title: Lesions in Animals Fed Enzyme Inactivated Frozen and Irradiated Meats

Task No. 00

The AFIP continued as the monitor and reviewer for the U. S. Army of pathology findings in experimental and control animals on the long term wholesomeness testing of radiated meats. AFIP pathologists performed five site visits to contractor's laboratories between 1 Oct 77 and 30 Sept 78. Specimens from 312 animal cases consisting of 4,158 paraffin blocks were received at the AFIP and accessioned in the Registry of Veterinary Pathology. Two hundred twenty of these cases were from the irradiated beef study performed by Industrial Biotest Laboratories. Results of the pathology review indicated that Biotest diagnoses and characterization of lesions in both control and experimental animals were at an acceptable professional level. However, numerous errors in the transcription of pathology data were noted together with numerous missing tissues and some mislabeling of blocks. Review of the pathology findings in these animals was stopped when the Biotest Laboratory contract was terminated in Oct 77. All specimens submitted to the AFIP from the irradiated beef study have been placed in the AFIP repository until such time as instructions on their disposition is received from the project manager.

Since Dec 77 major emphasis has been placed on the handling of pathology data generated on the irradiated chicken study performed by Raltech Scientific Services, Inc. All aspects of the pathology studies have been addressed in meetings with the contractor's pathologist and the project officers. A system for coding the distribution, severity and duration for all lesions has been developed that is amenable for computer storage and retrieval. In addition notation will be made of all organs examined including those without lesions assuring that the pathologic data will permit the computation of incidence tables for each type of lesion in relationship to the major experimental variables.

AFIP pathologists have worked closely with the contractor's pathologists in the standardization of coding all lesions. Efforts in this area included the detailed review of eleven cases initially evaluated in the early part of the study by the contractor's pathologists. Findings were categorized by differences in diagnoses as to major or minor discrepancies. These differences were discussed in detail in a joint meeting of the project officer and the contractor.

Consultation was provided to the project's officers and contractor on the cause of neonatal deaths in the rat and mice colony that occurred in the latter part of Dec 77. The contractor had initially suspected infections with pinworm as the principal cause of the death; however, since these

parasites essentially never produce fatal infections, and pathologic lesions attributable to the parasite could not be demonstrated, other causes were suspected. Subsequent investigations by project officers revealed the problem was likely associated with improper husbandry procedures that were in practice during the holiday season or related to inbreeding of the rat colony. Direct consultation has also been provided to the contractor's pathologist on the classification of neoplasms prior to rendering a project diagnosis, on dermatitis occurring in the beagle colony and on the etiology of encephalitic lesions in mice which was suspected as due to a neurological strain of the hepatitis virus. An orthopedic anomaly that was detected in beagle pups on the breeding study was evaluated at AFIP and by AFIP orthopedic consultants. The condition has been diagnosed as achondrodysplasia of the distal ulnar growth plate. This is a genetic condition that has previously been reported in other breeds of dogs and recognized by commercial breeders in beagle colonies.

The AFIP now has received 92 cases from the contractor that were requested for histopathologic study after reviewing 222 contractor's pathology reports. These cases, consisting of 553 paraffin blocks, are now being processed for histopathology review.

Sufficient data on the professional pathology performance of the contract has not been obtained to permit firm conclusions on its quality. In the early stages of the project there was a delay in the completion of pathology studies, but recent progress indicates a time lag of less than six months between sacrifice of animals and completion of pathology studies. A time lag of not less than 90 days is expected and has been set as a goal by the contractor. Although based on the review of a limited number of cases the pathology portion of the study is judged as satisfactory at this stage.

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